Research Supporting Sound Decisions

Joint Fire Science Program

2005 PROGRESS REPORT

An Urgent Mission

The year 2005 set a new record of over 8.5 million acres burned nationwide, surpassing the 2000 fire season which also exceeded 8 million acres. But it was a different fire year than 2000 and probably not noticed by many. Instead of forest fires, range fires in the Great Basin burned over 2 million acres and once again over 4 million acres burned in Alaska.

As the result of an increasing volume of fuels in some ecosystems; recent increases in the frequency, intensity, and length of seasonal droughts in some parts of the United States; and a growing number of homes in the wildland urban interface, there is an urgent demand for credible science that can help managers and elected officials mitigate and prioritize efficient and effective fuel treatments.

Fire issues are not confined to populated areas alone. Of increasing concern is large fire activity in sparsely populated places such as Alaska. The past two fire

A Unique Mission

Created by Congress in 1998, the JFSP was established to provide scientific information and tools in support of fire and fuel management programs. Key elements include:

- Partnership and dialog between managers and scientists to prioritize research needs
- Focus on science delivery and successful on-the-ground adoption and application of science findings and technology
- Responsive through an annual competitive proposal process that delivers results quickly
- Provides the scientific information and tools to integrate fire into longer term land and resource management and implementation plans

JFSP research is driven by the needs of managers and policymakers for sound scientific information and new tools to help support decision making. Over 40 percent of funded projects are demonstrations and studies that are focused specifically on the needs of local managers for site-specific information necessary to help plan fuel treatments, fire management recommendations, or restoration and rehabilitation of burned sites and degraded ecosystems.

Research Focus

The JFSP conducts management-oriented research and development in four primary focus areas:

1. Fuel Inventory and Mapping
2. Effects of Fuel Treatments
3. Scheduling of Fuel Treatments
4. Monitoring and Evaluation

In the 2001 appropriation legislation, the mission of the JFSP was expanded to include post-fire stabilization and rehabilitation. Congress also supported continuation of program emphasis on exploring new remote-sensing approaches for wildfire and fuels research and monitoring, rapid response projects, and projects to meet the local needs of managers.

The Thirst for Information

The need for science-based decision making has always existed, but the demand for credible science information is increasing as fire and land management agencies take measures to restore fire-adapted ecosystems to healthy conditions.

The foundation of JFSP research is sponsorship from federal land managers for all local needs projects. The program encourages manager-scientist dialog in the development of all research proposals to focus limited resources on the most critical issues and to rapidly deliver information and tools that can make a difference.

seasons have set all-time records for acreage burned in Alaska. These are sometimes intense fires that burn to the permafrost. We are just beginning to understand the interrelated effects and consequences of major fires in the boreal forest.

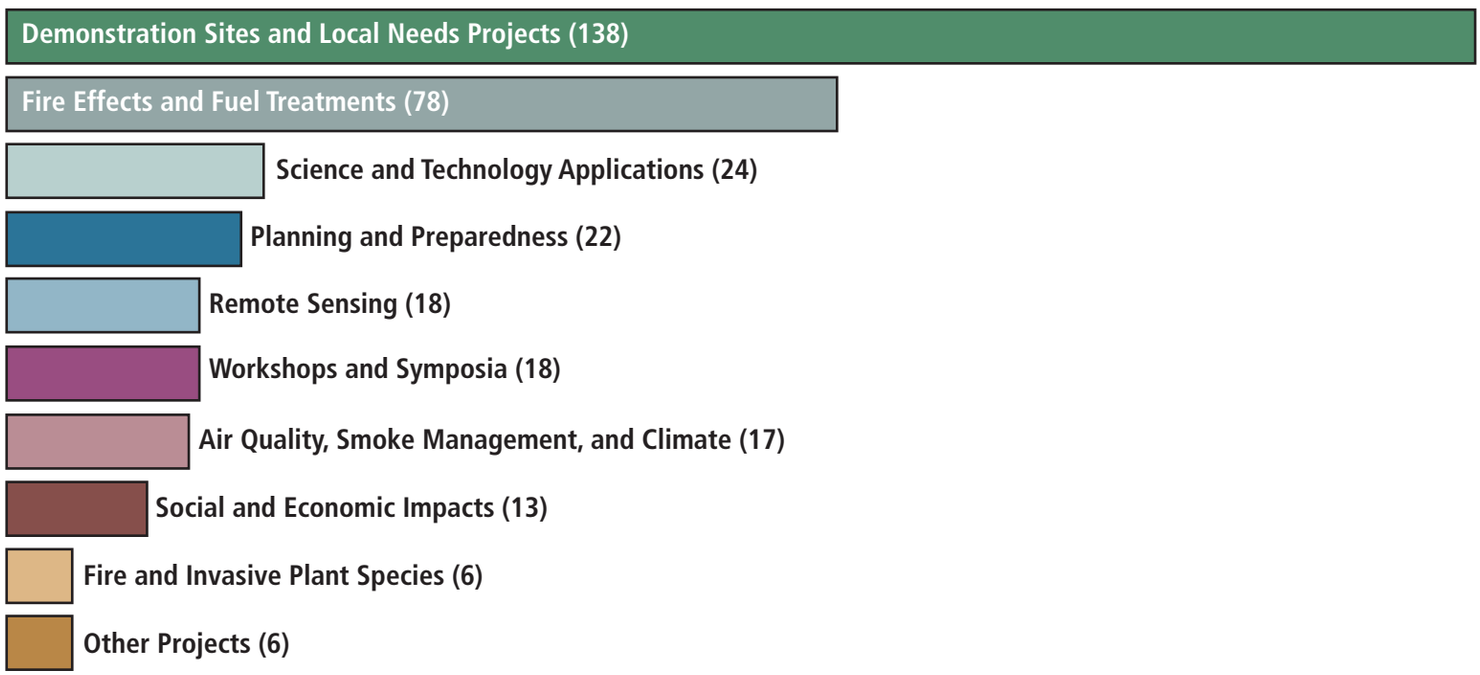
Over the last 150, years there have been profound changes in the Great Basin with invasion by cheatgrass and the woodland species pinyon pine and western juniper. Unfortunately, there is a lack of information available to managers on the consequences of methods they might use to reduce fire risk or to restore more desirable plant communities and fire regimes. The Joint Fire Science Program (JFSP) has launched a 5 year, $13 million research program to help Great Basin land managers with these issues

The strength of the JFSP lies in its unique capability to quickly customize research and respond to the needs and issues of fire managers and policymakers.

New Projects for 2005

Two hundred seven (207) proposals were submitted and fifty six (56) projects were funded in 2005. Since the inception of the JFSP, 340 projects have been awarded (see chart). A requirement for every project is federal agency participation. Partnerships between managers and scientists, combined with a focus on making results available on the ground, are key ingredients for awarding project funding and ensuring the future success of implementation.

JFSP Projects by Categories



An Investment in the Restoration of the Great Basin...

The sagebrush biome encompasses over 100 million acres in the arid western United States. Over the last 150 years, there have been profound changes in the Great Basin with invasion by cheatgrass and the woodland species pinyon pine and western juniper. Unfortunately, there is a lack of information available to managers on the consequences of the methods they might use to reduce fire risk or to restore more desirable plant communities and fire regimes. For 2005, the JFSP invested over $2 million ($13 million total over the next 5 years) to gain a greater understanding of the effects of fire and other fuel management treatments to restore sagebrush communities in the Great Basin.

The responses to fire and fire surrogate treatments will be measured by an array of ecological, economic, and social variables chosen because of their interest to managers and stakeholders, such as:

- Providing managers with improved information to restore big sagebrush communities that have been invaded by non-native grasses or by pinyon and juniper
- Matching the temporal and spatial scales at which managers operate

Promising Research

Can we save firefighter lives with better safety zones?

Firefighter's lives depend on safety zones because a situation can go bad in an instant. Researchers are working to identify the physical characteristics that determine how safe a safety zone is. Specialized sensors and cameras are deployed directly in the path of an oncoming fire and in potential safety zones to record the magnitude and duration of heating as well as air temperatures and speeds. As a result of these efforts, new guidelines consider not only the size of the safety zone, but also how the presence of multiple firefighting crews and their equipment and vehicles will affect the safety zone's effectiveness as a safe haven from fire injury. Recommendations have already been incorporated into the incident response pocket guide and current wildland firefighting training curriculum. The bottom line is an improved margin of safety.

Principal Investigator:
Bret Butler, Rocky Mountain Research Station

Putting It All Together for Fire and Fuel Managers

Despite extensive development efforts, simulating fuel treatments at the project or watershed level remains a complex process. There is a puzzling array of unlinked software and no overall framework for project specialists to analyze and visualize fuel treatment scenarios. Specialists charged with National Environmental Protection Act (NEPA) analysis of proposed fuel treatments remain largely baffled by the array of existing tools and required data formats, and how they can be leveraged for project level work. Researchers in La Grande, Oregon, are developing tools, such as ARCFUELS, to address this problem. The project is especially designed to facilitate the integration of corporate databases with commonly used software, such as FVS, SVS, and FLAMMAP and FARSITE wildfire models. The project also helps specialists interpret outputs from the Forest Vegetation Simulator and extensions.

Principal Investigator:
Alan Ager, Pacific Northwest Research Station

- Providing managers with information that will allow them to better evaluate tradeoffs inherent in the choice of management alternatives
- Delivering information to understand how the entire ecological system changes in response to fire and fuel treatments
- Developing user guides that feature the latest information on how managers can best treat invaded sagebrush communities with the common tools available to them

…And More

In addition, we are also making investments in the following areas:

- Prescribed fire and biological control of salt cedar
- Options for thinning pinyon-juniper in the wildland urban interface
- Postfire seeding evaluations to suppress cheatgrass
- Mt. Zion National Park evaluation of fuel treatments created by non-native plants
- Control of invasive annual grasses in the Mojave Desert

Gridded Winds Technology: New Tools for Incident Commanders

Topography affects wind flow, but fire behavior models have typically relied on constant wind direction and speed. Scientists adapted commercial fluid-dynamics software to predict wind flow over complex terrain. The new WindWizard tool was applied to 50 wildland fires nationwide between 2003–2005, generating over 400 simulations of wind fields used by meteorologists, fire behavior analysts, and incident commanders to improve fire behavior understanding and decision making. The gridded wind outputs are used to make maps of wind flows and can be imported into FlamMap and FARSITE for spatial fire behavior simulations. This new tool helps incident commanders allocate critical resources and improves their ability to manage fires safely and efficiently.

Principal Investigators: Mark Finney and Bret Butler, Rocky Mountain Research Station

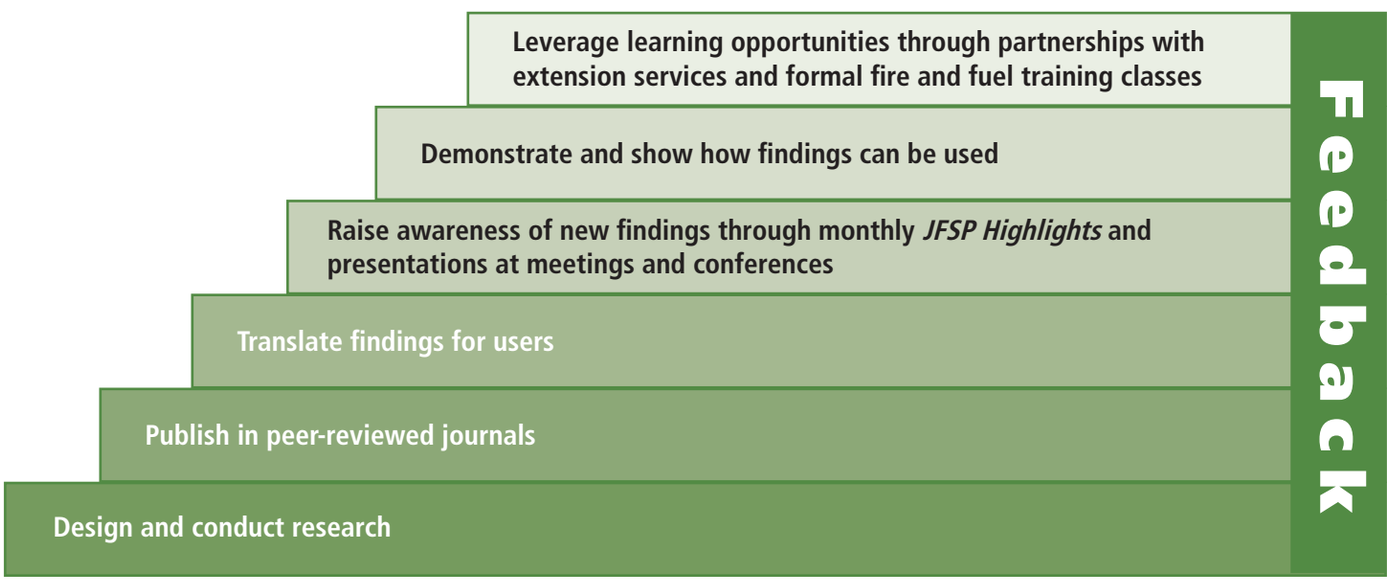
Focused on Science Delivery

Structured Science Delivery

Successful science delivery means that research is applied and makes a difference on the ground or in longer term policy decisions. The JFSP believes early and ongoing involvement and partnership with potential users on proposal development and project implementation and testing can guide and speed the creation of tools, knowledge, and solutions that are useful for the intended customer.

The JFSP's goal is to develop an effective and efficient framework for science integration and knowledge adoption and to promote dialogue among managers, on-the-ground practitioners, and researchers. That is why JFSP-sponsored research projects begin with a manager–scientist dialogue exploring the manager's needs. This dialogue leads to defining the manager's expectations and how the research team can fulfill those expectations. The process ends with the delivery and application of information and tools designed for the manager. Feedback is solicited throughout all steps of this process to refine and clarify outcomes.

Steps in the Science Delivery Process



Funding to Support Science Delivery

The JFSP not only supports new research, but funds the development and support of science delivery projects. Initial efforts focus on enhancing and building on existing successful applications first. Three existing applications that fire and fuel managers depend on are BehavePlus, FlamMap, and FARSITE. BehavePlus is used for applications such as predicting the behavior of an ongoing fire, prescribed fire planning, and fuel hazard assessment. It is part of other National Wildfire Coordination Group training courses. FlamMap is used for landscape fuel and fire potential assessment. The JFSP also funds creation of additional materials, online help and tutorials, and training presentations.

A Critical Examination of JFSP Science Delivery

The JFSP has commissioned an independent examination of the integration of new scientific findings into management practices with specific attention to:

- Evaluating the impediments to integrating new information into practice
- Describing changes in operations that will improve integration of new information
- Recommending ways to manage the science integration process that uses successful existing practices and institutes ways to test and adopt new ones

Adopted Research

The first research results from the JFSP were delivered in 2001. Since that time, practical research products have helped managers make informed decisions in the Departments of Agriculture and Interior, state agencies, and local communities. Following is a very brief description of several key research projects supported by the JFSP that fire and fuel managers and decision makers rely on every day.

Nationwide Fire Regime Condition Class System

Researchers characterized and mapped historical natural fire regimes and current vegetation conditions nationwide at a 1-km resolution scale. The project led to the development of an index to describe departure from historical fire regimes (condition class). The Fire Regime Condition Class System (FRCC) is widely used at national, regional, and state levels in reporting hazardous fuels reduction accomplishments under the National Fire Plan, strategic planning, assessments of ecosystem health, and risk assessment. The definitions also have been incorporated into field guidance on fire regime condition class description at the site level. FRCC will be a key output of the LANDFIRE project.

Principal Investigator: Colin C. Hardy, Rocky Mountain Research Station

Before LANDFIRE

Sometimes a bigger project develops from a smaller-scale research effort. LANDFIRE is a 5-year, multi-partner project that will provide land managers with border-to-border and coast-to-coast wildland fire, vegetation, and fuel maps. This ambitious venture was made possible in part by the JFSP-funded Southern Utah Fuels Management Demonstration Project, started in 1999. The southern Utah project served as a 15-million-acre prototype for LANDFIRE and provided essential baseline data for estimating large-scale project costs and timelines. Scientists developed and validated landscape-level data sets, which provided guidance for future LANDFIRE development teams. This early investment in southern Utah yielded proof that the goals and objectives of LANDFIRE were achievable nationwide.

Principal Investigator: Kevin Ryan, Rocky Mountain Research Station

FIREMON: Fire Effects Monitoring and Inventory System

Monitoring ecosystems after fire provides an understanding of the consequences of fire on vegetation, wildlife, soils, and other ecosystem components. Monitoring is also the critical feedback loop that allows fire managers to constantly improve prescriptions and fire plans based on new knowledge gained from field measurements. FIREMON provides a consistent and comprehensive nationwide fire effects monitoring and inventory system. It has been adopted by the Bureau of Indian Affairs as its standard fire monitoring package and is in wide use throughout the nation.

Principal Investigator: Duncan Lutes, Rocky Mountain Research Station

Marrying Forest Change Predictions to Fire Behavior Modeling

Fire managers have long sought ways to couple fire behavior predictions to changes in forest structure and composition. The Fire and Fuels Extension (FFE) provides this linkage, joining the state-of-the-art Forest Vegetation Simulator that enables managers to predict changes in fire behavior and effects in response to thinnings and other treatments for most forested United States ecosystems. As an example, the Coronado National Forest uses the software to compare the effects of alternative treatments on fire hazard, fuel loading, species composition, and forest structure. Fire managers at the Klamath Falls Resource Area of the Bureau of Land Management use FFE to estimate crown fire hazard in late-successional reserves.

Principal Investigator: Gary Dixon, USDA Forest Service, Washington Office

ALFRESCO

Fuel buildup is undesirable for two reasons. First, it can cause catastrophic wildland fires; second, it may cause changes in the natural fire regime that adversely affects animals and plants, which in Alaska, native Alaskans are dependent on for subsistence. Scientists are developing a computer model, called Boreal ALFRESCO, that will incorporate information on fuel buildup, vegetation, climate, and fire management policy with real geography over a range of time scales from decades to centuries. This model will depict the responses of vegetation to multiple scenarios of fire management, fuel buildup, and climate change, and will assist land managers in designing and implementing fire management plans.

Principal Investigator: Scott Rupp, University of Alaska, Fairbanks

Stabilizing Post-Fire Sediments

For decades, wildfire rehabilitation specialists routinely relied on contour-felled logs to reduce hillslope erosion and retain soil sediment produced after wildfires. Federal land managers have spent over $14 million in big fire years to install and maintain these felled-log sediment traps. In a rapid response approach, scientists installed monitoring equipment to test which erosion mitigation treatments worked best. They found that once 10-minute rainfall intensity reached approximately 2 inches per hour, a common occurrence with short-duration high-intensity thunderstorms, the contour-felled logs performance was significantly reduced and lost the ability to check sediment. Mulching treatments proved to be more effective at reducing hillslope erosion during the same rainfall episodes. As a result, managers have reduced investments in contour-felled logs saving tens of millions of dollars, and shifted treatment choices to mulches that are more effective.

Principal Investigator: Pete Robichaud, Rocky Mountain Research Station

New Research Questions

How can I restore an ecosystem when I don't know what the historical conditions were?

Land managers are asked to restore land to historical conditions, yet there is little or no information available about past natural fire regimes. Historical fire regime information is lacking for many ecosystems such as tundra, taiga, grassland, wetland, deciduous forest, tropical, subtropical, and shrubland. Fire scar analyses have provided historical fire return interval, seasonality, and fire size information for many conifer forest types, but have been less successful in other vegetation types. As managers attempt to mimic natural cycles, this critical information is a necessary first step in the restoration process.

Beyond when and where?

Other historical fire regime attributes, such as fire intensity, fire severity, fire type, and spatial complexity, are not known for most ecosystems. These attributes are closely related, but difficult to ascertain. The JFSP wants to develop this information for areas where it is not available and believes new methodologies such as remote sensing, GIS, and spatial analysis, coupled with fire history, might prove useful to fire managers.

What if we add in climate change?

Current fire and fuel management programs assume that today's climate will continue into the future. Climatologists have proposed several alternative future climate scenarios, which could change the role of fire on the landscape. Fire managers need tools to assess such changes using existing ecosystem models and predicted climate scenarios, including changes in temperature, precipitation, and lightning patterns.

What is the warranty period on a given fuel treatment and how often should maintenance be scheduled to keep the treatment effective?

Communities and land management agencies are annually treating millions of acres of wildland fuels; however, there is little information available to help guide decision makers about maintaining effective fuel treatments.

Communities and fire managers need analysis and tools to:

- Estimate how long treatments fulfill the required objectives (what is the treatment life span)
- Develop a matrix to assess and describe potential maintenance treatments and costs
- Determine the scheduling and timing of maintenance activities
- Assess the capabilities of existing software and decision-support tools for evaluating treatment life span and/or maintenance requirements (costs, scheduling, timing, activity type)

At the Joint Fire Science Program we provide funding for:

- Developing new knowledge
- Building applications that are useful to fire and fuel managers
- Validating existing research through field trials
- Integrating management needs and research discoveries

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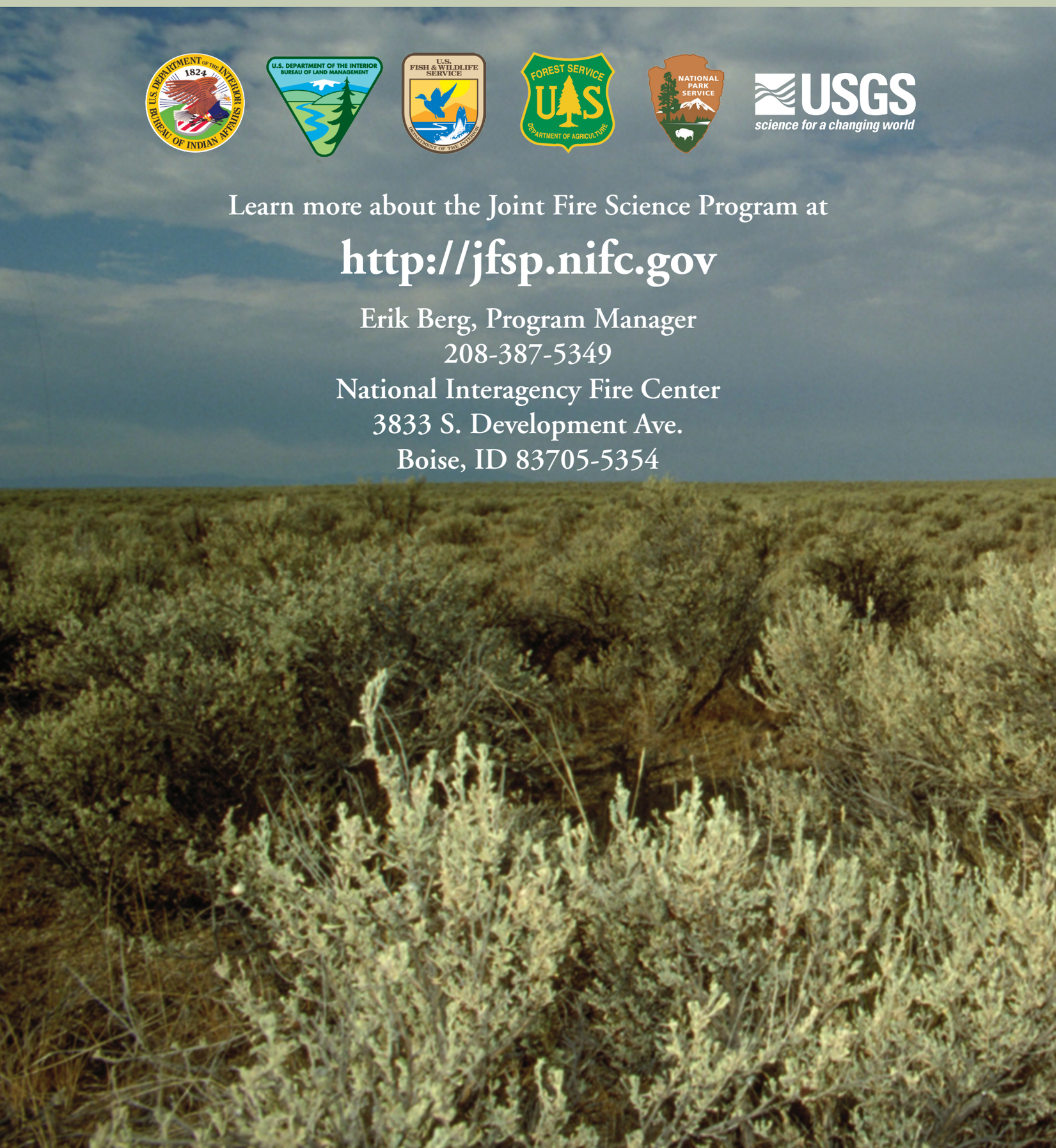
An Interagency Research Partnership



Learn more about the Joint Fire Science Program at

http://jfsp.nifc.gov

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